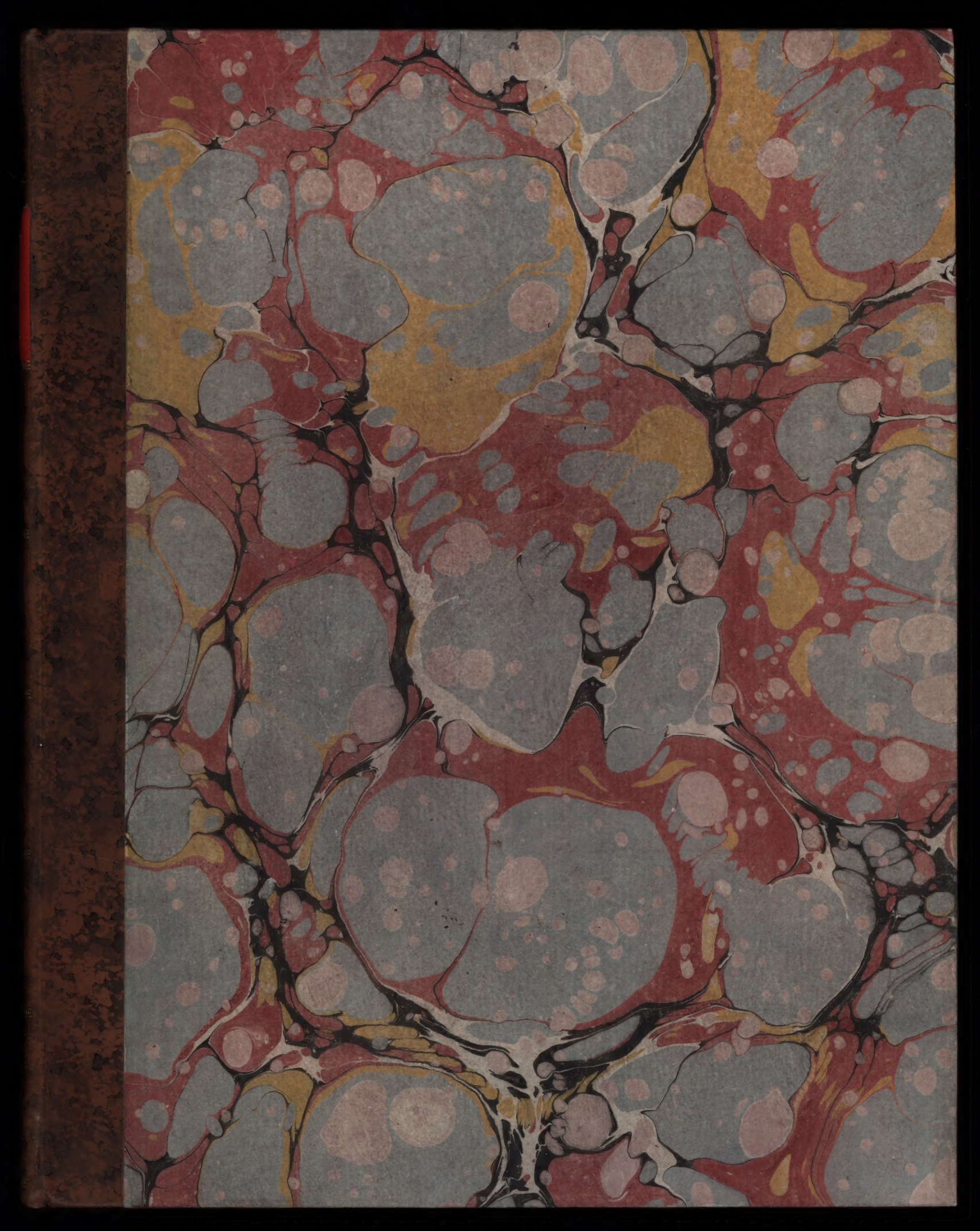


OR,

An Essay

ON

THE ANALOGY AND HARMONY

OF

COLOURS.

London:

PRINTED FOR THE AUTHOR,

BY A. J. VALPY, TOOKE'S COURT, CHANCERY LANE;

AND SOLD BY

MR. NEWMAN, SOHO SQUARE.

1817.

PREFACE.

THE following Essay was designed to form part of a Treatise on the nature, preparation, and relations of colours. The time necessary, however, to so arduous an undertaking,—the want of an elementary book on the relations of colours,—and the advice and approbation of several distinguished artists, have induced the author to publish it as a separate work.

The principle or plan of development pursued therein,

belongs to *an universal archetype;** for all analogy is founded in universal relations, or the universe is not a system of order and wisdom, but of confusion and folly, without unity, harmony, or design. Of such universal relation, the coincidences of Music and Chromatics, hereafter adduced, are indicative:—coincidences which pervade all the *sensible sciences;* thence extending on the one hand to the *natural or material,* and on the other, to the *moral or intellectual sciences,* in universal harmonious relation.

That the system before us is conformable to nature, is ocularly demonstrated by the immediate exhibition of its objects, an advantage peculiar to Chromatics; and that it is consonant to universal reason is evident, because greater

* See an Essay intitled TRITOGENEA, in the *Pamphleteer,* No. XVII. p. 101.

simplicity, or greater variety comprehended under such simplicity, cannot be conceived in any system: this attempt therefore addresses itself to reason and common sense, and requires but few preliminaries.

It may be expected, notwithstanding, that some account should be given of the doctrines delivered by preceding authors upon light and colours, yet such an attempt would conduct far beyond the proper limits of an elementary treatise, at the same time that literature contributes very little to the purpose of the present Essay. Some works of a similar design were, however, recently put into the author's hands by the late worthy and lamented Dr. Taylor, of the Society of Arts, &c. whose information concerning colours was not less extensive than his urbanity.

The earliest of these was the tractate of Le Blon, entitled *Coloritto, or the Harmony of Colouring*, in which he recognizes the title of the ancient Greeks to an *Ars Chromatica* unknown to the moderns,—distinguishes the qualities *inherent* and *transient* in colours, by the terms material and impalpable, and divides them into primary and secondary. White he describes as a compound of the primitive impalpable colours, and black as a like compound of the palpable. True painting, he says, represents *light* by white, and *shade* by black,—reflections by *yellow*, and turnings-off or roundings of objects by *blue*. Such is the outline of the brief and perspicuous theory of Le Blon, which, however deficient or defective, verges upon the truth and simplicity of nature.

Le Blon is followed by Harris in a similar tract, intitled *The Natural System of Colours,* in which he teaches nearly the same doctrine. He distinguishes colour into *prismatic* and *compound,* the first of which he subdivides into *grand primitives* and *mediates,* and these he defines by comparison with the tints of flowers. He denominates his *compound primitives,* olive, slate, and brown,—bears testimony to the composition of black by his *grand primitives,* and the consequent neutralizing power of colours,—and, finally, illustrates his system by two diagrams, in which the above relations are exhibited in 36 sections, subdivided into 660 tints: this distribution is, however, arbitrary, the hues and shades of colours being indefinite or infinite.

To the above, succeed some other publications of a

like design; but, since they add nothing of importance to the foregoing, they may be passed over; the union of brevity, with perspicuity, being ever most conducive to science.

CHROMATICS.

§ 1. The term Chromatics denotes the science of the relations of *light*, *shade*, and *colours*.

§ 2. Light, shade, and colours, are either *inherent*, as in pigments, &c. or *transient*, as in the sun-beam, rainbow, prismatic, spectrum, &c.* The first arising from reflection, the latter from refraction, &c.

§ 3. Inherent light and shade are called *white and black*; and in their transient state, they are denominated *light and dark*, &c.

* See the Appendix.

§ 4. *The principles of light and shade* are correlative, co-essential, and concurrent in every visual effect: accordingly the light of day, and the sun-beam itself, are compounds of light and shade; nor is *pure* light, or its opposite, in any case an object of vision.

§ 5. These principles have therefore three states or modes of concurrence; one SENSIBLE, as above (§ 3.) another LATENT, as in colours, and a third in which the sensible and latent are COMPOUNDED; thus the principles of light and shade are co-essential and concurrent *latently* in the colours of pigments, &c. which also variously participate of these powers *sensibly* in the variety of their depth and brilliancy (§ 25.).

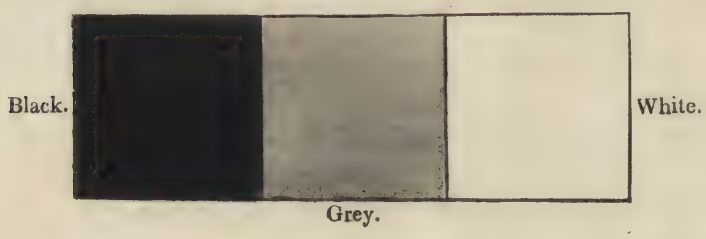
PARTICULAR RELATIONS

OF

COLOURS.

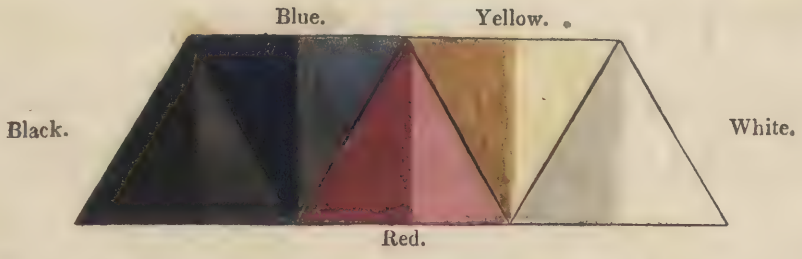
§ 6. THE principles of light and shade, in their sensible state, have two extremes and a mean, denominated, inherently, WHITE, BLACK, and GREY; the intermedia or degrees of which are indefinite or infinite.

EXAMPLE I.



§ 7. These principles have also a similar triple relation latently, both which relations are compounded or conjoined in colours. Accordingly, when in latent concurrence, the element or principle of black or shade predominates, it determines the colour BLUE; when that of white or light predominates, it determines the colour YELLOW; and when these principles concur without predominance, they determine the medial colour RED.

EXAMPLE II.

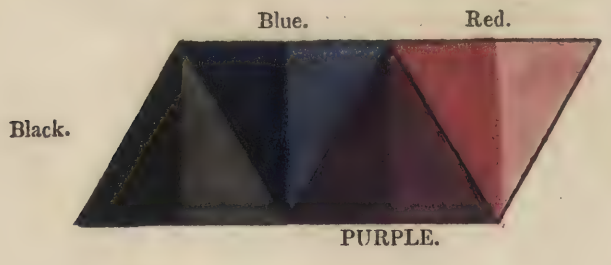


§ 8. By the union of these three *positive colours* in due subordination, they are neutralized, and the *negative colours* grey, &c. elicited by a transition of their principles from latent to sensible concurrence.

§ 9. Thus the PRIMARY COLOURS resulting from the analysis, or concurring in the synthesis of these principles or fundamentals in union are *three;* the lowest number capable of uniting in variety, harmony, or system; and this variety of union can be only three.

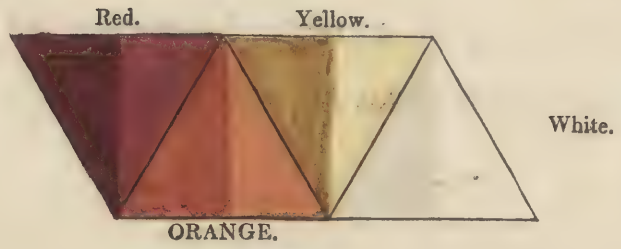
§ 10. First, from the mixing of the primaries blue and red; proceeds the secondary PURPLE on the dark extreme.

EXAMPLE III.



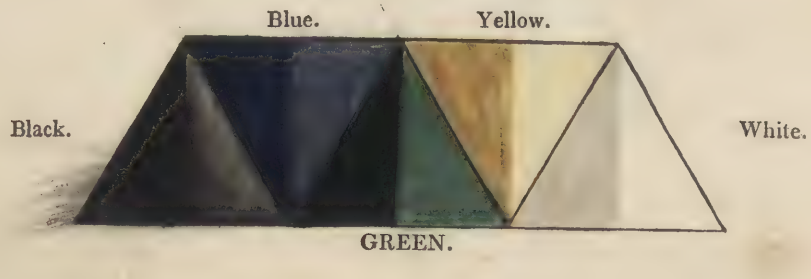
§ 11. Secondly, from that of yellow and red proceeds ORANGE on the light extreme.

EXAMPLE IV.



§ 12. And thirdly, from the union of blue and yellow, proceeds medially the secondary GREEN.

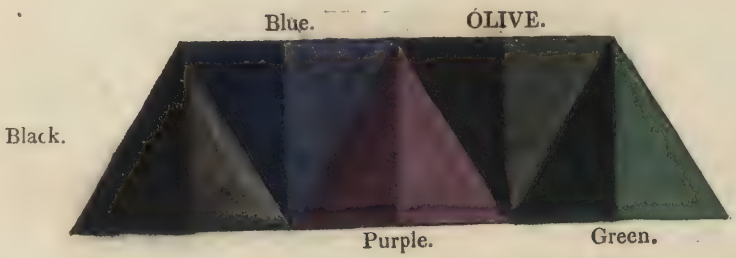
EXAMPLE V.



§ 13. It follows, of course, that the SECONDARY COLOURS are capable of the same variety of union as their prima-

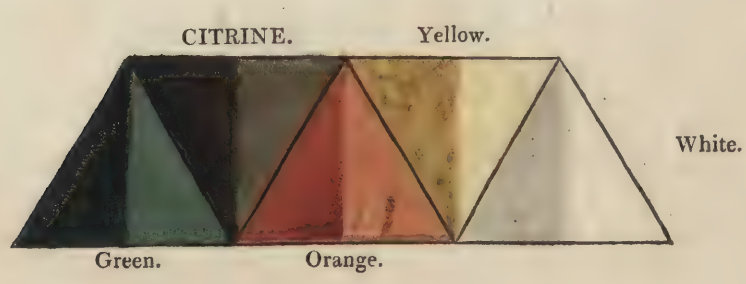
ries, and with like relation to their fundamentals: accordingly from the pairing of the secondaries purple and green proceeds the tertiary OLIVE, on the dark extreme.

EXAMPLE VI.



§ 14. From that of green and orange, on the light extreme, proceeds the tertiary drab, or CITRINE.*

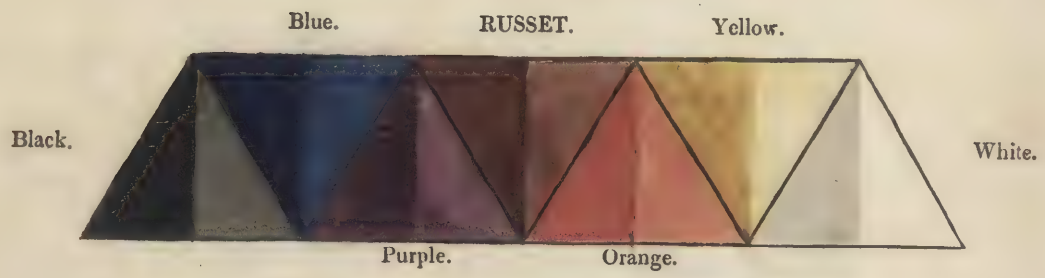
EXAMPLE VII.



* See Appendix, Note V.

§ 15. Finally, from the union of purple and orange, proceeds the medial tertiary RUSSET.

EXAMPLE VIII.



§ 16. Of these TERTIARIES, blue predominates in, and gives its relations to the *olive*, yellow to the citrine, and red to the *russet*.

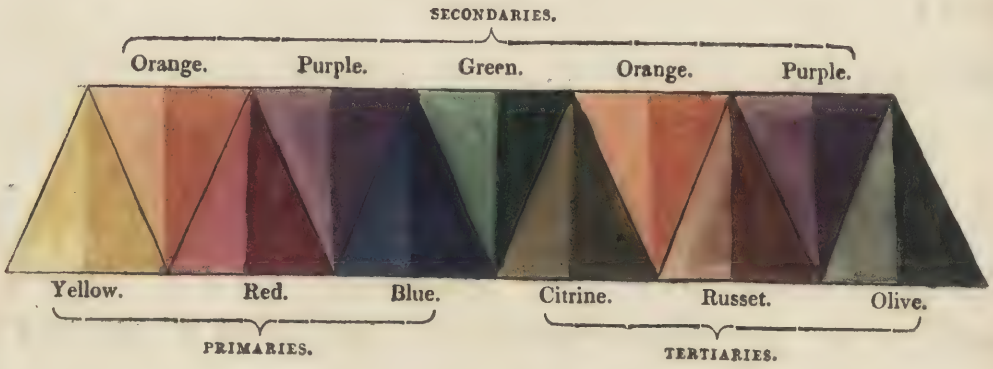
§ 17. As in each of the secondary colours *two primaries* meet, so in each of the tertiaries *the three primaries* are united; it follows hence that no new distinctions can proceed from the triple combination of the tertiaries; accordingly their compounds take the indefinite term BROWN, though better denominated russet-olive, olive-russet, &c.

(Example 10.) The browns may, however, be compounded upon the same triple principle in an infinite progress and approach to the neutral *grey*, the extremes of which are *black* and *white*.

§ 18. There remain yet the collateral or indirect relations of colours; first, of a primary with a secondary; secondly, of a primary with a tertiary, and finally, of a secondary with a tertiary; but these may for the present be passed over, since they afford us no new distinctions.

§ 19. We may therefore terminate the series of colours thus deduced from their principles, in one united scale as they arise, in the natural order and relation in which the secondaries spring from the primaries, and the tertiaries from the secondaries, in progress from light to shade.

EXAMPLE IX.



§ 20. Such are the *particular* distinctions, relations, and gradations of colours, as determined by the various predominance of their first principles through an orderly and infinite progress to the neutral grey; the position at which this predominance terminates, and the equilibrium of these first principles is re-established in unity according to a naturally perfect system.

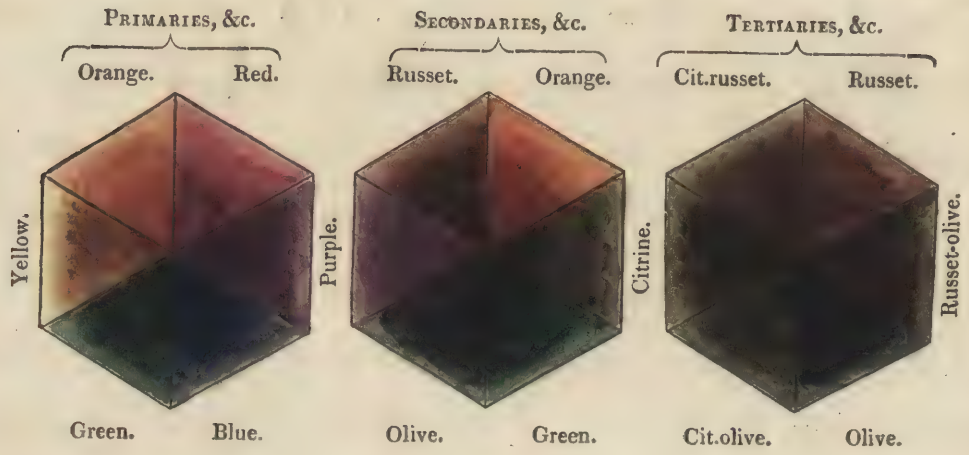
§ 21. As the *neutralization or negation of colours* depends upon the reunion of the three primaries, (§ 8) it is evident that each of the *primary colours* is neutralized by that

secondary which is composed of the two other primaries, alternately : thus blue is neutralized or extinguished by *orange*, red by *green*, and yellow by *purple*.

§ 22. For the same reason each of the *secondaries* is neutralized, more perfectly, by that tertiary in which the remaining primary predominates :—thus purple is neutralized by *citrine*, green by *russet*, and orange by *olive*. The same follows of the tertiaries, &c. Hence there is an unity, accordance, or harmony of opposition, as well as of succession, in colours.

§ 23. Accordingly the primaries, secondaries, and tertiaries are thus opposed in the following diagrams, with other coincidences.

EXAMPLE X.



§ 24. The compounds of the latter order of colours approach near to the perfect neutral. *Perfect neutrality depends, however, upon a due subordination of the primary colours* in which blue predominates in proportion to the depth of the compound, and yellow is subordinate to red ; (§ 30) or *of the secondaries* in which purple predominates, and orange is subordinate to green, (§ 38) or finally *of the*

tertiaries, in which olive predominates, and citrine is subordinate to russet, (§ 42.)

§ 25. All the foregoing colours primary, secondary, &c. in their reciprocal combinations have infinite intermedia or degrees, whence the boundless variety of *hues*: they have also infinite intermedia between the extremes of depth and diluteness, whence also the boundless variety of *shades*.

§ 26. Upon the *gradation of hues and shades*, depend the sweetest effects of colour in nature and painting, analogous to the effect of succession or melody in musical sounds: they may therefore be termed the *melodies of colour*.

§ 27. The accordance of *two colours* in the foregoing examples, coincides with what the musician terms CONCORD; which is *the agreement of two sounds either in consonance or succession*: the opposite of which is *discord*.

Thus also HARMONY, both with the Musician and Chromatist, signifies the accordance of *three or more sounds or colours in consonance or opposition:* but this belongs to the *general relations* which follow.

GENERAL RELATIONS,

OR

HARMONY OF COLOURS.

§ 28. NEXT to the *particular* are the *general relations of colours*. The effect of the first is *melody*, that of the latter *harmony:* terms borrowed from acoustics, appropriate to the accordance of musical sounds, and, by a strict analogy, perfectly significant.

§ 29. As the relation of harmony in colours is consonant, or co-expansive, and an evident triunity governs the

Chromatic* system, the most proper figure in which to illustrate the correlations of colours is the equilateral triangle; it has therefore been adopted for this purpose.

§ 30. The most simple *general relation* of colours is that of the primaries and their principles reciprocally, exemplified in the following diagram between the extremes of *black or shade* at the centre, and *white or light* at the circumference. Accordingly, the central black therein, is an actual composition of the primaries which surround it, in which *blue* is the predominant colour, and *yellow* subordinate to *red:* and as there is an order converse to the above, from white in the centre to black at the perimeter, we have denoted it by the inverted triangle, circumscribed them by an iris or orb of the primaries, and radiated the intermediate space with the *neutral grey;* the whole of which is conformable to theory and consonant to visual sense.†

* The term *Chromatic,* throughout this essay, refers to colours only, when not otherwise distinguished.

† Note VIII.*

PRIMARY HARMONIES.

§ 31. The second general relation or harmony of colours is that of the primaries with their secondaries and principles reciprocally, as exhibited in the following diagram upon the same archetype or plan as the preceding.

§ 32. It has before appeared in what manner the secondaries proceed from their primaries. In the present diagram this appears again, together with their general or interchangeable relation and subordination: for the particular is comprehended in the general.

§ 33. The first general relation or harmony of colours is herein also again represented under a more general reference, in which its relations to three other harmonies by which it is bounded appear.

§ 34. The superior of these bounding triangles, in which red is the archeus or predominating colour, may be

termed the *harmony of the red*, the dexter, that of the *yellow* and the sinister, that of the *blue*.

§ 35. Not only are these distinct harmonies of the primaries, but they constitute also a *more general harmony* in triunity : the sides of the general triangle taken either severally, or in succession, are also *melodies*, distinguished, each, by its archeus or ruling colour.

§ 36. In like manner, every musical composition has *a principal tone or sound predominant*, which is called the KEY to which every other sound refers; so also in every harmonious composition of colours there is *a principal tone or predominant colour*, to which its other hues refer subordinately. In Chromatic composition also, as in music, there is evidently a subordination of the archei or keys.

SECONDARY HARMONIES.

§ 37. Next to the harmonies of the primaries with their secondaries, are those of the secondaries with their tertiaries, in like order and coincidence: they are accordingly exhibited in the succeeding diagram.

§ 38. The central triangle in this figure, comprehends the secondaries in relation to the principle of shade: for, since the primaries unite in black or shade, and the secondaries are composed of primaries, it is evident that *the secondaries in union also constitute black.* Accordingly, the central black is an actual compound of the secondaries which encompass it; in which also *purple* predominates, and *orange* is subordinate to *green.*

§ 39. The three extreme triangles of the figure by which the above harmony of the secondaries is bounded, are also distinct harmonies, the archei or predominating

principles of which are, first, in the upper triangle *green*, secondly, in the dexter *orange*, and thirdly, in the sinister *purple:* they may accordingly be denominated harmonies of these colours respectively.

§ 40. These various harmonies united, constitute one more general harmony, and in all other respects also does the present diagram coincide with the preceding. (Example 12.)

TERTIARY HARMONIES.

§ 41. There remain yet the general relations or harmonies of the tertiaries with their subordinates and principles, which are accordingly exhibited in the following diagram, conformably to the foregoing.

§ 42. Thus the central triangle of the present figure comprehends the tertiaries in relation to black or shade; the same reason or relation by which black is composed of the secondaries, constituting it also more intimately of the tertiaries, their original constituents being those primaries which also compose black; accordingly, the tertiaries of this triangle are the components of the *black* at their centre, in which *olive* predominates, and citrine is subordinate to *russet*.

§ 43. Again, the three extreme triangles by which the above harmony is bounded, are also distinct harmonies, the

archei of which are, in the superior triangle *russet*, in the dexter *citrine*, and in the sinister *olive*, by which names therefore we may distinguish their respective harmonies.

§ 44. And, finally, these several harmonies, as connected, constitute a more general harmony. In all other respects also does the present coincide with the foregoing diagrams: it is evident also, upon comparing the ten first Examples, in which the particular and opposed relations of colours are exhibited, with these three diagrams, that the former are detached portions of the latter, and as such constitute, and are comprehended in them.

§ 45. Having discussed the principal general relations of colours, we might proceed to others more remote; but since it has been determined that distinction ceases beyond the tertiaries, and the principle of predominance upon which it depends, equilibrates in the neutral grey, we may here terminate the series of general harmonies by the following universal

COROLLARY:

THAT THERE CAN BE NO PERFECT HARMONY OF COLOURS IN WHICH EITHER OF THE THREE PRIMARIES, (SIMPLE OR COMPOUNDED) IS WANTED; AND THAT THE DISTINCTIONS OF HARMONY DEPEND UPON A PREDOMINANCE OF ONE, AND A SUBORDINATION OF THE OTHER TWO IN THE COMPOSITION.

UNIVERSAL RELATION

OF

COLOURS.

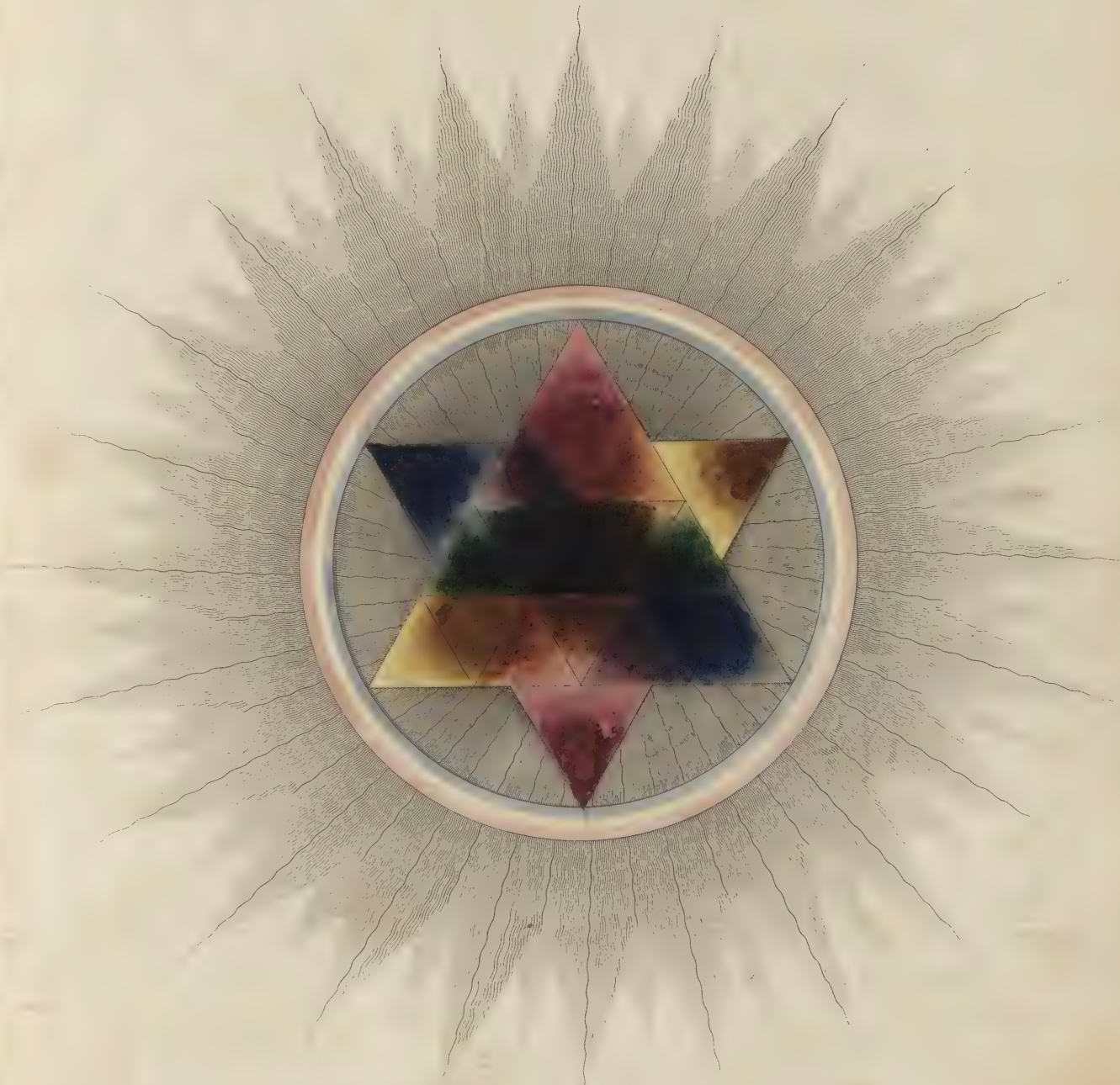
§ 46. As particulars are included in generals, so are both these involved in the universal. Having therefore briefly discussed the particular and general relations or harmonies of colours, there remains, finally, that *universal relation or harmony* by which they are comprehended; and this is accordingly exemplified in the following universal scheme.

§ 47. In this scheme of colours we retrace the synthetical path of the foregoing, beginning analytically with black

at the centre in harmony with the *tertiaries*, which harmony resolves into those of the *secondaries* with the *primaries* by which the triangle is terminated, and by an orb of which the whole is circumscribed in one universal harmony: for there is a progress through *colour* to latent negation in *black* or *white*, (§ 17. Example 9.) as well as to sensible negation through diluteness and depth (§ 5.)

§ 48. The series of colours which constitutes the sides of the general triangle in this diagram, presents also distinct melodies, or harmonious gradations before exemplified in discussing the particular relations of colours: thus the present example comprehends the preceding in one, or universally.

§ 49. By similar diagrams, farther subdivided, the more complex harmonies or relations of colours may be exhibited upon the same analogical principle; it is evident also that by changing the ground from white to black, the order of these diagrams may be inverted; since, however, pre-



ference is due to simplicity, such farther illustrations are unnecessary.

§ 50. The cultivated eye of the artist will discern that perfect pigments and execution are alone wanted to render the foregoing schemes totally, and in their parts, harmonious, so that any subordinate portion severed from the rest, is itself an independent harmony: they may therefore be considered as theoretically perfect.

§ 51. If the foregoing theory be well founded, *the Chromatic system, like the universe, is an absolute unity comprehending a relative infinity*:—a perfect system !

§ 52. The developement of colours from its principles is therefore, as it were, a violence done to its unity, and it is in restoring this unity, without violating the relations or lesser unities it comprehends, that we produce the various harmonies.

§ 53. Thus harmony consists in relation, and springs from the reunion of that which is naturally one or united; (§ 21) the feeling or perception of harmony is therefore a perception of relation or unity, and the more intimate such relation or unity is, the nearer to perfection is the harmony.

§ 54. Accordingly, the chaste eye receives greater satisfaction from the harmony of the tertiaries in which the three primitives are more intimately combined, and approximate to that absolute unity from which they proceeded: and for the same reason, the correct eye demands a concurrence of the three primitives in every harmony; yet the vulgar or uncultivated eye delights most in the combinations of the primaries, and is rarely offended at their disunion, disproportion, or discordance.

§ 55. Thus that which is most harmonious or beautiful to the merely sensible or uncultivated eye, is least so to

the cultivated or intellectual eye; to the first the more simple and distinct relations are suited; to the latter, the more comprehensive and refined.

§ 56. There is a bound, however, to this refinement of harmony, when the relations of the primaries as principles become so remote or complex that indistinguishableness ensues; and this bound is sameness or *monotony*.

§ 57. To what extent the power of vision may reach in this direction, or how far nature has gone, may be difficult to determine; but it is evident, in her works, that she delights most in the latter harmonies, and distributes the former with a sparing hand. Consonant to this also, has been the practice of those artists who have coloured best, in steering equally clear from the extremes of crudeness and monotony: accordingly, in nature, and the best pictures, the broad harmony of landscape, &c. lies in the latter relations, while the more confined harmonies of flowers, &c. belong to the former.

§ 58. By thus refining upon the simple unity or accordance of the primary triad, we arrive at the three genera of harmony in colours, (Example 12, 13, and 14) and it is remarkable that the musical genera of the Greeks were three, distinguished also by a similar characteristic of refinement, and requiring the same cultivation of perception, while their *genus spissum*, in which the three genera were reduced to one system, accords with Example 15, in which the three preceding diagrams are united. Without, however, presuming too much upon such coincidences, we deem it important to incline attention toward them: an opinion sanctioned by the great Bacon, in his doctrine of *parallel or conformable instances.**

§ 59. Indeed, there is a boundless analogy by which the sciences and arts are connected, whence they mutually reflect light upon each other, and the relation in this

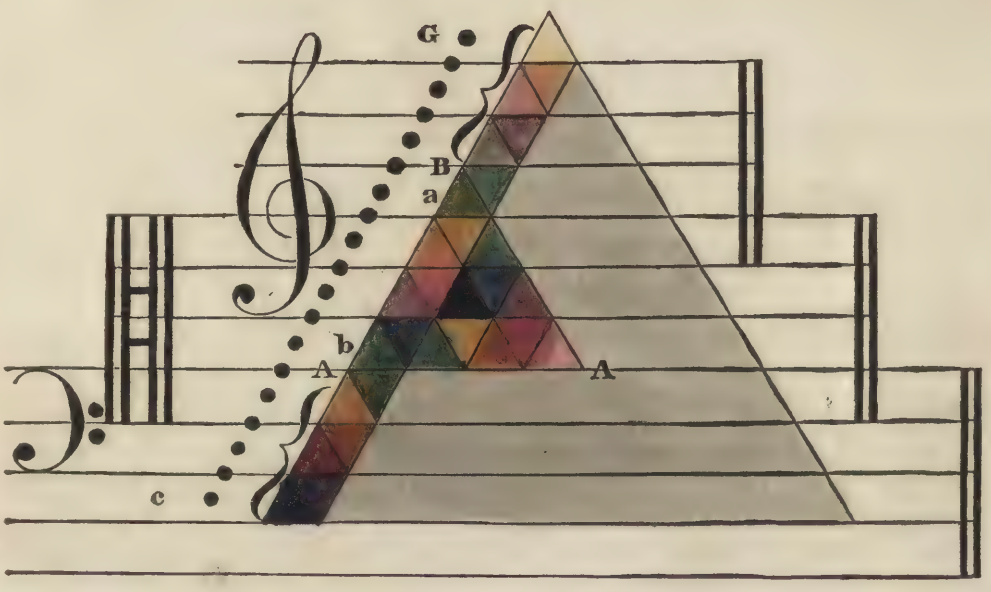
* Nov. Org. Part II. Sect. II. Aph. 27.

respect is so intimate among the sensible arts as to make us suspect in them a natural identity of form: hence, the remarkable conformity of the science of colours with that of sounds already so often referred to, which the illustrious Newton attempted to establish upon a geometrical basis, and of which the very terms these sciences use in common are indicative. In no instance is this more evident than in the corresponding relation of the primary colours, and the three notes C. E. G., which constitute the common chord in music: and as it is by the inversion of this common chord that the musician obtains the other two perfect consonances E. G. C., and G. C. E., so by a similar transposition of the primaries, we get in the three sides of the triangle, Example 12, three perfect consonances of colours. Musicians, it is true, denominate the two inversions, imperfect concords, not as less satisfactory to the ear, but as unfit to commence or terminate a composition: in this too colours resemble sounds, since the inversions of their common chord or primary triad, blue, red and

yellow; though perfect in *consonancè*, are imperfect in *series*.

§ 60. These coincidences of colours and sounds may be illustrated by the following diagram, in which the Chromatic scale, (Example 12.) A. A. B. is unfolded and accomodated to the diatonic series of the musician from C. to G.; the notes of the latter being opposed to the corresponding tints of the former, and the common chord occurring in each of the three clefs associated with the primary triad of colours opposed to each other: in this comparative scale, the concords and discords of the two systems are also singularly coincident.

EXAMPLE XVI.



ANALOGOUS SCALE OF SOUNDS AND COLOURS.

§ 61. In the Chromatic series, thus accommodated to the scale of the musician, one of the semitones of the octave falls between the notes B. and C., or *blue* and *green*, which colours are discordant, and require the intermediate demitint opposed to the semitone, to satisfy the eye, to connect the octaves in series, and to complete the harmony of the scale ; the other semitone falls between E. and F., opposite to *red*, which is the medium of the primary triad, and the eye requires it to be semitonic, or subordinate, in nature and painting ; the two scales are subject also to similar proportioning and temperament: in fine, their correspondence in the present point of view is equally remarkable throughout, and merits the attention of the artist.

§ 62. Nor are these coincidences, or those which refer to the music of ancient Greece, undeserving the notice of the learned musician, as a clue to the restoration of the genera. We therefore recommend them to his attention,

it being beside our design to speculate concerning the lost arts of antiquity:—suffice it, that the examples we possess of its works, justify our belief of the excellence of those which are known to us only by their reputation; —nor ought we to lose sight of the remarkable tradition, that it was by THE PRINCIPLE OF ANALOGY (whatever it was, and wherever they got it) that the Greeks carried the arts to the very acme of perfection.

§ 63. To conclude: the principal distinction of the two systems is, that the notes of sound are *separated by intervals or spaces*, while the notes of colour are *the spaces themselves;* for colour, as expansible quantity, bears the same relation to *space* that musical sound, as quantity successive, does to *time:* the Chromatist has therefore not only his MELODY AND HARMONY, but he has also, if the variety of expanded quantities may be so expressed, his *breves* and *minims*, *quavers*, and *semiquavers*, *&c.* or RHYTHM. And this relation of colours answers to that

which, in their music, the ancients called *harmonica* and *rhythmica* theoretically ; or practically to their Melopœia and *rhythmopœia*.

§ 64. It is evident also that colours have a science as distinct from any association with figure or forms, as that of musical sounds is from figurative language or poetry. Hence the field in which the Chromatist may exercise his genius, is as extensive as that of the musician : to teach the science in all its bearings, is, however, beyond the purpose of an essay designed principally to illustrate THE ANALOGY OF COLOURS.

APPENDIX.

AN APPENDIX,

CONTAINING

NOTES, &c.

RELATING PRINCIPALLY

TO TRANSIENT COLOURS.

Note I. § 4. (The Principles, &c.) It lays beyond the sphere of a science, to demonstrate the absolute nature and ground of its first principles, because they are its essential conditions: it belongs not therefore to Chromatics to determine what the principles of light and shade are in themselves, or whether their effects belong to their objects, to their visual subject, or more truly to the concurrence of both.* It is reasonable, notwithstanding, to believe that the physical principles of colours coincide with their æsthetical or sensible relations; that

* See Note VI.

therefore the material or chemical principles of pigments are an *active or oxygenous* substance coincident with *light*, and a *passive, phlogistic, or hydrogenous* substance coincident with *shade*, and that these concur in the physical production of colours. If such be the case, the variety of colours in bodies, depends upon the variety of their affinities for the two principles of ordinary light, whereby bodies absorb, or reflect these principles in different proportions.

Note II. § 5. (These Principles have three States, &c.) *Caloric*, the parallel principle of light, has also its *sensible* and *latent* states, and passes from the former to the latter, when in action on passive substances it determines them to the solid, liquid, and elastic forms, &c. And this coincidence is still more remarkable in electricity, wherein an active and reactive, or positive and negative principles are admitted, analogous to, if not the identical principles of, light and shade.

Note III. § 7. (When in Latent Concurrence, &c.) That colour does depend physically upon a latent concurrence of those principles which are sensible, transiently in light and shade, and inherently, in black and white, is demonstrated synthetically by their composing the neutral grey; since this negative colour is also produced by a composition of the three positive colours blue, red, and yellow, &c.

Again, analytically; by the refraction of a prism, the *negative ray* is resolved into the positive colours blue, yellow, and red, &c. in which blue lays toward the shade, and yellow toward the light. Farther, the necessary subordination of colours in the synthesis of the neutral black, in which blue predominates, and yellow is subordinate, evinces that in the analysis or evolution of colours from their first principles, blue is allied to the passive principle of shade, and yellow to the active principle of light; between which is red: acordingly, red is supereminently a colour.

The same doctrine may be further illustrated by the following experiments. Lay a parallelogram of black paper upon a sheet of white paper upon a table; or the following figure,

and standing two or three feet distant therefrom, so adjust a triangular glass prism parallel thereto, that the parallelogram may be viewed

through it refracted nearly at your feet; it will then exhibit a spectrum of which the following is a copy.

Apply at the same time one leg of a pair of compasses horizontally to the angle C. of the above parallelogram, the other leg passing beyond A., when the blue of the spectrum will be seen within the compasses at c. a., and the yellow without, while the red will lay between them partly within, and partly without the compasses. It appears hence, that the blue is produced by the refraction of the light of the white ground E., into the shade of the black parallelogram, and the yellow by a contrary refraction of the black into the white F., while the red appears to be generated partly in both these ways.

The spectrum E. F. is produced still more brilliantly if the parallelogram be placed against the clear light of a window, and viewed in such position.

By mixture of the three colours according to the proportions in the spectrum E. F, the black A. B. C. D., is recomposed. Thus light and shade appear again to be the principles of colours both analytically and synthetically.

The same may be shown by a variety of similar experiments, but the above exhibits, at the same time, most simply the true order and relations of the primary triad blue, red, and yellow, and their compounds.

Exp. 2. If instead of black upon a white ground, we repeat the experiment with a white object upon a black ground, blue takes the place of yellow in the spectrum, without the compasses, while the yellow lays between the red and blue, within them. Hence also the blue is educed by the refraction of light into shade, and the yellow by a contrary refraction of the shade into the light of the object accompanied by red of an orange cast : some red of a purple cast also accompanies the blue, but it is generally lost upon the shade of the ground.

Exp. 3. If, instead of black or white, a grey object be placed partly on a black, and partly on a white ground, and viewed as before, the spectrum will exhibit the colours in the order of the first experiment, on the white ground, and in that of the second experiment, on the black

ground; yellow opposed to blue, red to yellow, and blue to red. It is not necessary that the objects and grounds thus opposed be black and white, it is sufficient that they be lighter and darker than each other: nor is it necessary that they be not coloured. Thus a blue, red, or yellow object, upon a ground lighter or darker than itself, yields coloured spectra in the like order and relations of the foregoing: hence, each and every colour is an effect or concurrence of the principles of light and shade, and each colour yields the others reciprocally.

It is true the spectrum from a yellow object affords but a faint blue, and that the colour of each object predominates in its spectrum, but the first evidently arises from the deficiency of the principle of shade in yellow, and the latter from the breadth of the objects.

Finally, if objects striped, or otherwise variously coloured, be refracted by the prism upon light or dark grounds, they afford spectra in the above manner of objects uniformly coloured.

Exp. 4. Hitherto, triangular glass prisms of a linear figure, have alone been used in chromatic experiments, but as this figure is generated by the rectilinear motion of a triangle, it is evident that such instrument is capable of infinite variation according to figures generated by the circular, angular, or compound motion of a triangle.

Accordingly, for the purpose of the present illustration, two LENTICULAR PRISMS were constructed, of which the following figures represent outlines:—the first *double convex*, generated by the motion of a triangle round one of its sides, forming, as it were, a circular prism: the second *double concave*, being a similar prism, the figure of which is generated by a like motion upon its refracting angle.

Fig. 1.

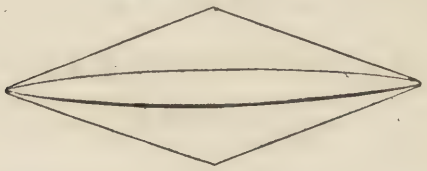
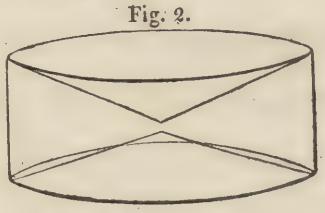


Fig. 2.



Between these, as extremes, lies of course an infinite gradation of intermediate figures generated by the circular motion of a triangle laterally upon one of its angles: but these latter and other figures are beyond our present purpose.

Exp. 5. To evince the concurrence of the principles of light and shade in the analysis and synthesis of colours by these instruments, let the black spot in the following figure be viewed perpendicularly through the above *convex prismatic lens* placed over it concentrically:

then gradually raising the lens above the spot, it will be expanded or refracted into the beautiful annular spectrum or aureola represented round it. If then the *concave prismatic lens* be placed over the convex lens in the above situation, the aureola will be, by a counter refraction, reduced to the spot at its centre.

Exp. 6. If, inverting the experiment, the above coloured circle be viewed, as before, by the *concave prismatic lens*, it will be reduced to the spot at its centre; and if then the convex lens be placed over it in that situation, it will by a counter-refraction restore the ring of colours.

These experiments may be performed with a white spot upon a black ground, or varied as in the foregoing experiments with the common prism.

Exp. 7. Accordingly, spots of blue, red, and yellow, &c. viewed as before, through the convex prismatic lens, afford spectra resembling the foregoing, in each of which the primary triad of colours is very distinguishable, and the colour of its appropriate spot predominant in each respectively. Hence they are natural illustrations of the distinctions of harmony in colours, § 34. and coincide with the consonance of the

primary triad in every musical sound, demonstrated by Mersennus, Dr. Wallis, and others.

They may also, as in Exp. 5., be reduced by the concave lens, to spots of their original colours.

Exp. 8. If, instead of a spot, an O or *small circle* be viewed, as before, through the convex prismatic lens, *two* concentric annular spectra resembling the above will appear; and these may be reduced as before by the interposition of the concave lens. And if two or more concentric circles be so viewed, the number of the annular spectra appearing, will, by an effect equally beautiful and surprising, be double the number of the circles viewed, owing to the circles being circularly refracted.

Exp. 9. That such is the cause, we may be convinced, by viewing, in like manner, a broad spot inscribed in a narrow circle, thus: ◉ when the single iris resulting from the spot will appear between the double iris of the circle: there is therefore a double incidence and refraction, the one prismatical or angular, the other circular; whence the great extent of the spectra of this instrument, compared with those of the common prism.

Exp. 10. By a ray of the sun admitted into a darkened chamber through a circular opening in the window-shutter, nearly of the diameter of the lens (or by any strong light similarly managed) and received at its entrance upon the convex prismatic lens, a magnificent iris or coloured bow is produced, which being intercepted by the concave lens, is reduced to ordinary light.

Many other beautiful and instructive experiments may be performed by these instruments, to facilitate and extend the use of which, a *Chromascope* has been constructed.

Note IV. § 12. (MEDIALLY THE SECONDARY GREEN.) It is worthy of remark that *green* is the centre, the absolute mean of the middle order of colours, (Examp. 9.)

In nature also, *green* appears to be the harmonic mean of which the extremes are the *light* of the sun, attended by *yellow*, and its surrounding *shade*, the sky, by *blue;* which colours are the elements of green.

Note V. § 16. (OF THESE TERTIARIES, &c.) Some ambiguity will unavoidably arise from the indefiniteness of the names of colours; even the primaries, blue, red, and yellow, are used vaguely and with great

licence, and this latitude of signification increases in the denominations of the secondaries and tertiaries, so that the terms we have adopted are liable to be disputed. Since, however, these terms express gradations of hue and shade, they are *general terms*, indicative of a class of objects, and do not denote particular or individual tints. To express the latter, language abounds with proper names, and fashion arbitrarily invents or adopts new ones, which by degrees become general, or confounded with the former, whence all accuracy of conception is put at nought.

Without therefore insisting upon the terms we have adopted, it becomes highly necessary to a clear comprehension of the true relations of colours, that general names duly limited, be appropriated to their classification.

Note VI. § 23. (With other Coincidences.) If a black object lying on a *white ground*, (e. g. a square inch of black paper upon a sheet of white) be viewed intently for a few seconds, and the view be then changed, with equal intentness, from the object to the ground, a white or light spectrum will appear upon the ground, of the figure of the object. If again a white object be similarly viewed upon a *black ground*, it affords a black or dark spectrum, and in each case the sur-

rounding ground will appear of a *grey*, which will be dark in the case of black, and light in that of white.

If, farther, a triangular opening be cut in a white paper, it will form a ground through which we may view in the same manner either of the colours of the diagrams, Exp. 10., singly and separately from the rest, each will then alternately afford a spectrum of the colour opposite to it in the diagram, by which it is neutralized; these spectra belong to the class of colours we have denominated transient, and to succeed in producing them with full effect, the activity of the organ is necessary.*

That these spectra are effects of the concurrence of the ground and the object, is rendered evident by viewing the objects surrounded by variously coloured grounds: thus, if after viewing an orange object upon a yellow ground, the eye be removed to a white ground, a spectrum appears of a green colour, and if on a red ground, it will be of a purple, and not blue, as in the former case. In these cases also, a shade of grey is cast upon the yellow and red grounds. Similar phenomena arise in viewing other colours similarly opposed, or several

* "The theory of *adventitious colours* which arise when the organ is intensely exerted, is a new and pleasing subject: it was first started by Dr. Jurin." Goldsmith's Exp. Phil. v. 2. p. 405. It has been further illustrated by the experiments of Buffon, Darwin, Rumford, and Galton. Phil. Trans. 1786, 1794.

colours surrounding each other upon the same ground: all of which depends upon the principle, that the colour, or colours viewed, whatever it be, produces a spectrum of a colour, which, mixed with it, makes up the complement of neutrality. We learn from the foregoing facts and experiments that shade, or colours allied to shade, yield that excitability to the visual organ which gives light or brilliancy to its objects; while light, or colours allied to light, exhaust its excitability, and affect its objects with dullness or shade.

They explain also why any colour viewed intently, declines in brilliancy to the eye, in proportion to the strength of the light in which it is viewed,—why black or shade is a good antagonist to all colours, by yielding that excitability to the eye—that spectrum of white or light—which casts brilliancy upon its objects.

They denote what colours opposed to each other harmonize with greatest effect.

They explain the illusory reflections observable when colours are opposed in strong lights: thus a white drapery opposed to a green wall in a good light, often appears beautifully pink, and if by any accident there be an undulation of light upon the wall, a similar undulation will appear upon the drapery, which effects belong to the eye, and not to

the object, and excite the illusion and anomaly of a red reflection from a green surface. The same extends to other colours.

Finally, they elucidate the remarkable effects of colours opposed in painting, and the changes produced by the introduction of a new colour into a picture.

Note VII. § 27. (THUS ALSO HARMONY, &c.) That sense in which harmony in painting depends upon opposition, is illustrated in Examp. 10., and in the hexagonal divisions of the succeeding diagrams; in which point of view, attention is due from the colorist to the manner in which harmony is effected in modern music by accompaniment.

Each colour also, in the same Examp. with its opposite, together comprehend variously the primary triad; hence an union or coalescence which constitutes harmony: these opposed colours are therefore concords, and have the musical relation of fourths; they accordingly stand as such in the comparative scale of sounds and colours, § 60., Examp. 16.

Note VIII. § 30. (ACCORDINGLY THE CENTRAL BLACK, &c.) As *blue* predominates in the composition of BLACK, it follows, that in attenuating black by mixture with white, it is necessary to add a portion

of *red*, and a greater proportion of *yellow*, (or the warm colour of their compound *orange)* to it, if we would preserve the neutrality of the tint; otherwise it will have the effect of blue, as in the colour of a clear sky, or the tints of black and white pigments.

Note *VIII. § 30. (Consonant to Visual Sense.) The eye itself—the organ of vision, presents in its structure, some remarkable coincidences with the system of colours: thus, it has three visible parts; the pupil, *black* and transparent, the sclerotis, *white* and opake, and between them, the iris semitransparent, and of *all colours*: and they form three concentric circles on the face of the eye, and possess the three powers of *transmitting*, *refracting*, and *reflecting* light. It has also internally a like numerical conformity in its three humours, the *aqueous*, *vitreous*, and *crystalline*, and its three coats, the *cornea*, *choroides*, and *tunica Ruischi*, &c.

Note IX. § 45. (Others more Remote, &c.) There is in painting a class of *harmonies of the greys*, unnoticed in the present essay, in which colour is almost undistinguishable. It is evident, however, that these follow after the harmonies of the tertiaries as a consequence of our theory. In nature too, these remote harmonies are beautifully exemplified in the clouds, &c.

Note X. § 50. (Perfect Pigments, &c.) The pigments principally employed in the preceding Examples are Ultramarines, the Rubiates and Indian yellow; the brightest and the deepest of each, in some instances strengthened in the shades by inferior pigments. It is evident, however, that if we possessed the three primitive colours in absolute or correlative perfection in pigments, such alone would be sufficient to compose all other hues and shades. Pureness, brilliancy, durability, depth, and transparency, are but some among the many requisites of a perfect pigment, never wholly united in the same substance: hence it is generally necessary to employ two pigments of the same colour if we would produce the fullest effect, the one allied to the principle of light, the other to that of shade—the one eminent for brilliancy or delicacy, the other for depth, strength, or intensity; for delicacy and depth in the beauty of colours are at variance in all pigments, so that when, in preparing them, we succeed in the one, we fail in the other, and when we unite them, it is with some sacrifice of both: they are the male and female in beauty: the principle is perhaps universal, and the Hercules, Venus, and Apollo, are illustrations of it in sculpture.

Note XI. § 20. § 51. (A Perfect System.) If *all* reason be allied to the *universal*, then must the development of reason, in a sensible

object, indicate the universal reason or intelligence to which it belongs. Dull of consciousness therefore will be the mind that in contemplating a system so simple, various, and harmonious, as that of colours, should not discover therein a type of that TRIUNE ESSENCE WHO COULD NOT BUT CONSTRUCT ALL THINGS AFTER THE PATTERN OF HIS OWN PERFECTION. For this reason, the Divine Wisdom that framed the world, gave *His image* not to man alone, but according to the oracle, *He filled the world with symbols of Himself.* And since of all sensible things colour is pre-eminent, for it gives value and distinction to whatever is visible, we may wonder the less that the perfection of form and system belongs supereminently to colours, or that they constitute a type of Universal Intelligence Himself.

" *The invisible things of Him from the creation of the world are clearly seen, being understood by the things that are made, even* HIS ETERNAL POWER AND GODHEAD." Romans I. v. 20.

THE END